SPECIFICATION

TITLE OF THE INVENTION

IMAGE READING DEVICE

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image reading

device for reading a document placed on a document

10   table with a color CCD sensor.

2. Description of the Related Art

In a color image reading device that is used as

an input portion of a color printer or a terminal of a

personal computer, even when an image in uniform

15   density is read, an image information that is output

from an image reading device may cause uneven color

density depending on pixels due to the lack of optical

uniformity as non-uniform illuminance of a light

illuminating the document surface, variance of

20   characteristic of a color CCD sensor, decrease in the

lightness of the visual field of a lens when reading

the light reflected on a document and converting into

image data by a color CCD sensor.

In order to compensate an uneven illuminance

25   caused by the optical factors mentioned above, so far

a white shading correction plate, etc. provided at the

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side of a document table is read bad photoelectric

converted into image data and the white reference is

judged from this image data whenever reading a

document and based on this white reference, the

5   shading correction is executed to correct the document

read data.

Further, in a color CCD sensor, when reading a

color image by dividing it into plural colors, the

read data may become uneven for each color because

10 there is a difference in spectral sensitivity

characteristics of R (Red), G (Green) and B (Blue)

filters. Therefore, in order to compensate the

sensitivity difference in R, G and B filters, the

shading correction is so far executed so far based on

15 a white reference and at the same time, the color

balance correction is executed so as to improve color

reproducibility as disclosed in Japanese Patent

Publication No. 6-57050.

However, the above-mentioned shading correction

20 and the color balance correction are so far executed

by reading the reflected light on the shading

correction plate provided at the side of a document

table and using this read value as the white reference.

Actually, however, the illuminance of the light

25 irradiating the shading correction plate is not always

agree with the illuminance of the light irradiating a

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document placed on a document table. Therefore, when the shading correction is executed based on the shading correction plate as the white reference, the color balance does not agree with that at the document

5 table and a delicate color difference is produced when reproducing an image by a printer, etc. Further, the shading correction plate is actually not pure white and therefore, the sensitivity difference of the RGB filters cannot be corrected.

10 On the other hand, the optical system for irradiating a document generally moves for scanning on a rail mounted in the main body of an image reading device and therefore, the accuracy control of the rail is required in order to obtain an image of high

15 reproducibility. However, the maintenance of highly accurate control is difficult and actually, the quantity of reflecting light from the document surface varies depending on the tilt of the rail in the sub-scanning direction and the uneven image density is

20 generated from the fluctuation in the quantity of light and a good image reproducibility is prevented.

Accordingly, for an image reading device, it is desirable not only to execute the shading correction and the color balance correction of image data but

25 also to correct a delicate color difference caused due to a difference in illuminance at the positions of the

shading correction plate and the document table. It is

further desirable to obtain a full color image of high

color reproducibility by correcting the color balance

so as not to produce uneven density in the sub-

5   scanning direction when reproducing an image

irrespective of distortion of the rail supporting the

scanning movement of the optical system to irradiate a

document.

10   SUMMARY OF THE INVENTION

An object of the present invention is to obtain

image data of good color reproducibility by correcting

image data so as to correct color differences that are

caused due to a difference in illuminance even when

15 illuminance in irradiation at the position of the

shading correction plate differs form that of the

document table when correcting the shading and the

color balance of image data.

Another object of the present invention is to

20 obtain image data of good color reproducibility by

correcting image data so as to obtain good density

reproducibility irrespective of fluctuation in

quantity of reflecting light in the overall area in

the sub-scanning direction due to the distortion of

25 the optical system at the time of scanning movement to

irradiate a document.

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According to the present invention, an image reading device comprising: a light irradiating means for moving and scanning while irradiating the light to a document table; a color photoelectric conversion

5   means for reading the reflecting light of the light from the light irradiating means for the photoelectric conversion; and a correction means for executing the shading correction and at the same time, the color balance correction and the stray light correction of

10   plural color signals that are photoelectric converted by the color photoelectric conversion means.

Further, according to the present invention, an image reading device comprising: a light irradiating device for moving and scanning the document table

15   while irradiating the light; a color CCD sensor for reading the reflected light of the light from the light irradiating device and photoelectric converting to plural color signals; and a correcting device for executing the shading correction, color balance

20   correction and stray light correction of plural color signals that are photoelectric converted by the color CCD sensor is provided.

Further, according to the present invention, an image reading device comprising: a light irradiating

25   means for moving and scanning a document table while irradiating the light; a color photoelectric

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conversion means for reading the reflected light of the light from the light irradiating means and photoelectric converting into plural color signals; and a correcting means for correcting uneven density of plural color signals photoelectric converted by the color photoelectric conversion means in the moving and scanning direction of the light irradiating means is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram schematically showing a structure of a color scanner and illuminance in the sub-scanning direction of the color scanner in a first embodiment of the present invention;

FIG. 2 is a block diagram showing an image signal processing system of a color scanner in the first embodiment of the present invention;

FIG. 3 is a spectral sensitivity characteristic diagram of a color filter used by a color CCD sensor 11 in the first embodiment of the present invention;

FIG. 4 is a diagram showing white document reading values, shading correction plate reading values, stray light correction desired values, and stray light + color balance desired value used for RGB shading correction in the first embodiment of the present invention;

FIG. 5 is a schematic diagram showing the time of reading a uniform density image document by a color scanner in a second embodiment of the present invention;

5   FIG. 6 is a diagram showing fluctuation in quantity of incident light to a color CCD sensor in the sub-scanning direction in the second embodiment of the present invention;

FIG. 7 is a diagram showing a desired value for a 10 color balance correction in the sub-scanning direction in the second embodiment of the present invention;

FIG. 8 is a schematic diagram showing measuring points on a document table in the second embodiment of the present invention;

15 FIG. 9 is a plan view showing measuring points on the document table in the second embodiment of the present invention;

FIG. 10 is a diagram showing fluctuation in the actual quantity of incident light to the color CCD 20 sensor in the sub-scanning direction in the second embodiment of the present invention; and

FIG. 11 is a diagram showing a desired value for the color balance correction in the sub-scanning direction actually executed in the second embodiment 25 of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described below in detail referring to the attached drawings.

5   FIG. 1 schematically shows a structure of a color scanner 10, which is an image reading device in a first embodiment of the present invention, equipped with a color CCD sensor 11, and is used in combination with a digital color printer 1. Above the color CCD

10   sensor 11, a document table 12 comprising a transparent glass plate is provided.

Blow the document table 12, there is provided an optical system 13 to irradiate a document G placd on the document table 12 and project the reflecting light

15   from the document G to the color CCD sensor 11. The optical system 13 comprises a reflector 14, a lamp 17 of which light is condensed to a sub-reflector 16 and illuminates the document G, first through third mirrors 18, 20 and 21, a filter 22, and a lens 23.

20   The reflector 14, the sub-reflector 16, the lamp 17 and the mirror 18 are mounted on a first carriage 24, and the second and the third mirrors 20 and 21 are mounted on a second carriage 26. The first carriage 24 and the second carriage 26 are driven by a motor 30

25   that is controlled by a control board 28 and reciprocates on a rail 27.

The lamp 17 is a linear shaped halogen lamp and
the illuminated light is reflected on the reflector 14
and the sub-reflector 16 and is applied to the
document G at the optimum light quantity distribution.

5   The light irradiated from the lamp 17 and reflected on
the surface of the document G is reflected on the
first through third mirrors 18, 20 and 21, and after
cutting the infrared rays by the filter 22, applied
to the color CD sensor 11 through the lens 23. The

10   color CCD sensor 11 photoelectric converts the
incident and reflected light from the document G into
color signals of R(Red), G (Green) and B (Blue).
These R, G and B signals are transferred to the
digital color printer 1 after the signal processing by

15   the control board 28.

On the document table 12, there is provided a
document table cover 13 to press the document G so as
to closely fit to the document table 12.

At the side of the document table 12, there is

20   arranged a white shading correction plate 32 that is
illuminated by the lamp 17 and read by the color CCD
sensor 11. The shading correction plate 32 is a white
reference plate for the shading correction to correct
the uneven luminous intensity distribution of the lamp

25   17 and the uneven sensitivity of the color CCD sensor
11.

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Even when an image in a uniform density is read, the output signal fluctuates depending on pixels due to such fluctuations in the optical system as non-uniform illuminance of light applied to the document surface, fluctuation in characteristic of a CCD sensor, decrease in brightness of the peripheral visual field of a lens. The shading correction is a method to obtain an image in a uniform density by correcting such fluctuation.

The shading correction is executed based on the white reference data and the black reference data. When the shading correction plate 32 (the white reference) is read, the quantity of light is attenuated at pixels at both ends of the main scanning direction. So, the shading correction is executed for every RGB signals according to a ratio between a difference of read image data of RGB signals that are input signals from the document G and the white reference data and a difference between the white reference data and the black reference data that is a dark environment read before lighting the lamp 17.

The shading correction is executed as shown in the following shading correction formula (1):

Correction value = K × (SIG - BK)/(WH - BK) ...(1)

(where, K: Coefficient of Correction, SIG: Read Image

Data, BK: Black Reference Data, WH: White Reference
Data)

FIG. 2 is a block diagram showing an image signal
processing system of the color scanner 10. The image
5 data read by the color CCD sensor 11 is divided into R,
G, B colors by a color filter 33 having spectral
sensitivity characteristics shown in FIG. 3 and
photoelectric converted to analog signals. The analog
converted image data is input into an A/D converter 36
10 via an amplifier 34 and converted into digital signals.

Next, the digital converted image data is input
into a shading correction ASIC 37, that is a
correcting means, wherein the color balance correction
and the stray light correction are executed
15 simultaneously with the execution of the shading
correction. The shading correction ASIC 37 is
controlled by a CPU 38. Further, an EEPROM 40 is
connected to the CPU 38. This EEPROM 40 stores a
white document read values (RW, GW, BW) that are the
20 white document data obtained when adjusting the color
scanner 10 and become desired values for the RGB
shading correction.

After the correction by the shading correction
ASIC 37, the image data is input to a registration
25 ASIC 41 and after correcting the out of read phase
caused by the arrangement of the color CCD sensor 11,

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output to the digital color printer 1. Because all of the shading correction, color balance correction and stray light correction of the image data are completed at the time when the image data is output to the

5 digital color printer 1 from the color scanner 10, the color correction only is made at the time when an image is developed subsequently in the digital color printer 1 and a full color image of good color reproducibility is easily obtained.

10 Next, the image data correction by the shading correction ASIC 37 will be described in detail. The shading correction ASIC 37 executes the shading correction of a digital converted image data output from the A/D converter 36 according to the shading

15 correction formula (1). At the same time, in order to correct a difference in spectral sensitivity characteristics of the color filter 33, the shading correction ASIC 37 adjusts the gain of the amplifier 34 so that the read values (RS, GS, BS) of the shading

20 correction plate 32 become the same as the white document read values (RW, GW, BW) that are the desured vakues for the RGB stray light correction.

The RGB stray light correction is executed in order to correct a difference between RGB signals

25 obtained by reading a white document (not shown) comprising a document in colors equivalent to the

shading correction plate 32 placed on the document
table 12 in advance and RGB signals obtained by
reading the shading correction plate 32 at its mounted
position when adjusting the color scanner 10. In
5   other words, the RGB stray light correction is to
correct the read values (RS, GS, BS) of the shading
correction plate 32 so as to substitute them with the
white document read values (RW, GW, BW) on the
document table 12. Because of this RGB stray light
10 correction, the desired value optimized at the reading
position of the shading correction plate 32 is set for
R, G and B, individually.

    This desired value is equivalent to the
coefficient of correction K of the shading correction
15 formula (1). When this correction is executed, a
difference of RGB signals when reading a white
reference document with RGB signals when reading the
shading correction plate 32 is corrected and converted
into color balanced values.

20   When further described in detail, as shown in FIG.
1, at the shading correcting position where the
shading correction plate 32 is read by the color
scanner 10, the light irradiated from a lamp 17a is
reflected on a shading correction plate 32a, further
25 reflected on first through third mirrors 18a, 20a,
21a, and is incident into the color CCD sensor 11. On

the other hand, at the position of the document table
12, the light irradiated from a lamp 17b is reflected
on the surface of the document table 12, further
reflected on first through third mirrors 18b, 20b, 21b

5 and is incident into the color CCD sensor 11.

As a result, the illuminance in the sub-scanning
direction of the arrow mark x of the scanning
direction of first and second carriages 24, 26
fluctuates as shown by the solid line (a). At the

10 reading position of the shading correction plate 32 of
the color scanner 10, the stray light is produced by
the atmospheric influence at the end surface of the
document table 12 and around the shading correction
plate 32 and its illuminance differs from illuminance

15 on the document table. Therefore, for instance,
assuming that the illuminance at the reading position
of the shading correction late 32 is higher than the
illuminance on the document table 12 as shown by the
solid line (a) in FIG. 1, when the stray light

20 correction is not executed, for the document data
reflected from the document G on the document tale 12,
an image data that is darker than the image output for
displaying an original image density of the document G
is produced and image reproducibility by the digital

25 color printer 1 is impaired.

Accordingly, the shading correction ASIC 37

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executes the shading correction using the white

document read values (RW, GW,BW) read at the position

of the document table 12 as desired values for the

shading correction and at the same time as the shading

5   correction, executes the stray light correction for

correcting a difference in illuminance between the

reading position of the shading correction plate 32

and the surface of the document table 12.

   Further, the color balance for correcting a

10   difference of spectral sensitivity characteristics of

the color filter 33 of the color CCD sensor 11 varies

according to a difference in illuminance between the

reading position of the shading correction plate 32

and the surface of the document table 12 and full

15   color image reproducibility is impaired. Therefore,

the shading correction ASIC 37 executes the color

balance correction by taking the correlation between

the white document values (RW, GW, BW) read on the

surface of the document table 12 and the read values

20   of the shading correction plate 32 (RS, GS, BS) as

desired values for the color balance correction and

executes the stray light correction and the color

balance correction simultaneously with the execution

of the shaing correction.

25   For desired values of the RGB stray light

correction and the color balance correction that are

executed simultaneously with the shading correction, based on a color filter of B (Blue) of low relative sensitivity, RGB radios (RS/BS, GS/BS, BS/BS) that are color balances are obtained from read values (RS, GS,

5 BS) of the shading correction plate 32 and the white document read values (RW, GW, BW) are used as absolute values because these white document read values are the desired values for the shading correction. That is, (Stray Light + Color Balance Desired Values)

10 become (RS/BS) x BW, (GS/BS) x BW, BW as shown in FIG. 4.

The color scanner 10 in a structure as described above reads a white document and sets desired values for the shading correction at the time of its shipment

15 or when adjusting the fluctuated characteristics of the optical system 13 at the time of replacement of a lamp for the maintenance. That is, a white document values (RW, GW, BW) read with the color CCD sensor 11 by placing the white document on the document table 12

20 are stored in the EEPROM 40.

Hereafter, when starting to read a document G on the document table 12, for setting white reference data for the shading correction, the reading operation of the shading correction plate 32 is first executed

25 and read values (RS, GS, BS) of the shading correction plate are read.

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On the other hand, the CPU 38 calls out the white document read values (RW, GW, BW) of the EEPROM 40 and from these values and the shading correction plate read values (RS, GS, BS) read from the shading

5 correction ASIC 37, sets the shading correction values so that they become the above-mentioned (Stray Light + Color Balance Desired values) (RS/BS) x BW, (GS/BS) x BW, BW and sets the shading correction ASIC 37 so as to execute the stray light correction and the color

10 balance correction at the same time of the execution of the shading correction.

Then, when the document G is scanned and a document image is read, image data separated into spectral components of RGB by the color CCD sensor 11

15 and then, subject to the color balance correction and the stray light correction after digital conversion via the amplifier 34 and A/D converter 36 by the shading correction ASIC 37. Then, after the out of phase of reading due to the arrangement of the color

20 CCD sensor 11 is corrected by a registration ASIC 41, the image data is output to the digital color printer 1 jointly to the address/data bus from the CPU. Thus, the digital color printer 1 forms a full color image using this image data.

25 When constructed as described above, the image reading device is able to execute the color balance

correction and the stray light correction simultaneously with the execution of the shading correction of image data by making white document read values (RW, GW, BW) that are read from a white

5 document placed on the document table 12 as desired values for the shading correction and is also able to execute the shading correction of image data and at the same time the color balance correction and the stray light correction and correct a delicate color

10 difference caused by a difference in illuminance between the reading position of the shading correction plate 32 and the surface of the document table 12.

Accordingly, when image data with the color balance correction and the stray light correction made

15 simultaneously with the shading correction as described above is input to the digital color printer 1, it becomes possible for the digital color printer 1 to easily reproduce a good color reproducible and high definition full color image. Furthermore, all of the

20 shading correction, the color balance correction and the stray light correction can be executed within the color scanner 10. Accordingly, when the image data output from the color scanner 10 after completing all the shading correction, the color balance correction

25 and the stray light correction is used, it becomes possible to suppress fluctuation of a reproduced image

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caused by the fluctuation in characteristic at the image forming apparatus side such as image forming terminals, etc. of a printer/a personal computer, and form a full color image in uniform quality.

5   Next, a second embodiment of the present invention will be described. This second embodiment is to correct irregular density caused by fluctuation in quantity of light due to the slip of the carriage in the sub-scanning direction when reading a document.

10   Therefore, in this second embodiment the same component elements as those described in the first embodiment are assigned with the same reference numerals and the detailed explanation thereof will be omitted.

15   The optical system 13 which irradiates the light to the document G on the document table 12 of the color scanner 10 and projects the reflected light from the document G to the color CCD sensor 11 is installed on the first and second carriages 24, 26 and scans on

20   the rail 27. Therefore, the horizontal degree of the optical system 13 to an image surface of the document G is decided by accuracy of the rail 27. Normally, even when the assembling accuracy and the installing condition of the rail are set rigidly, it is difficult

25   to completely eliminate the horizontal distortion and this horizontal distortion appears as an uneven image

density.

FIG. 6 is a diagram showing the fluctuation in quantity of light incident into the color CCD sensor 11 in the sub-scanning direction of the arrow x that is the scanning direction of the first and second carriages 24, 26 when the color scanner 10 reads the document G, and for instance, an example wherein the illuminance dropped at the rear end of the scanning is shown. The dotted line A in FIG. 6 shows a value when the image data was not corrected against the fluctuation in quantity of light and the solid line B shows a value after the image data was corrected against the fluctuation in quantity of light.

That is, if a desired values of the color balance correction in the sub-scanning direction at the shading correction by the shading correction ASIC 37 was set constant as shown by the dotted line C in FIG. 7, the quantity of light of the image data output to the digital color printer 1 after read by the color scanner 10 and the shading correction, the color balance correction and the stray light correction were executed drops as shown by the dotted line A in FIG. 6, and when an image is formed by the digital color printer 1, the uneven density is produced. In this case, therefore, as shown in the solid line D in FIG. 7, when a desired values for the color balance

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correction in the sub-scanning direction in the

shading correction is increased corresponding to

decrease in quantity of light, drop of the quantity of

light of the image data output to the digital color

5   printer 1 side is prevented as shown by the solid line

B in FIG. 6.

When further described in detail, an image

document H in uniform density is placed in advance on

the document tale 12 when adjusting the color scanner

10   10 as shown in FIG. 5 and this image document H in

uniform density is read at plural measuring points J1-

J3, K1-K3 and L1-L3; total 9 points in the matrix

shape on the document table 12; 3 point in the main

scanning direction, 3 points in the sub-scanning

15   direction as shown in FIG. 8. This read uniform

density image data is stored in the EEPROM 40. At

each of total 9 measuring points on the document table

12, image data of 80 x 80 pixels shown in FIG. 9 is

read and an average is obtained and a correction value

20   is obtained from this average value.

Then, to make the uniform density image data in

the sub-scanning direction at each of the measuring

points stored in the EEPROM 40 as desired values for

the color balance correction by the shading correction

25   ASIC 37, a coefficient of correction corresponding to

drop in quantity of light is calculated in the CPU 38

and a coefficient of correction K for correcting
quantity of light in the sub-scanning direction is
obtained. On the other hand, the RGB image data from
the color CCD sensor 11 of the document G read on the
5   document table 12 is applied with the shading
correction, the stray light correction and the color
balance correction by the shading correction ASIC 37
and at the same time, a coefficient of correction for
the color balance correction is changed at an interval
10   when the data is read at the observing points J1-J3,
K1-K3 and L1-L3 in the sub-scanning direction and the
uneven density is corrected.

     As a result, a coefficient of correction is
adjusted for every observing point J, K and L in the
15   sub-scanning direction and therefore, when desired
values for the color balance correction in the sub-
scanning direction at the time of the shading
correction are increased gradually corresponding to
the decrease in quantity of light, the quantity of
20   light of the image data output to the digital color
printer 1 is gradually corrected as shown by the solid
line E in FIG. 10. Hereafter, based on the image data
of which out of phase is corrected by the registration
ASIC 41, a full color image in nearly uniform density
25   corrected from uneven density is formed in the digital
color printer 1.

According to this second embodiment, when white document read values (RW, GW, BW) are set as desired values for the shading correction and further, image data in uniform density of a image document H on the

5   document table 12 that are read at plural measuring points J1-J3, K1-K3 and L1-L3 are set as desired values for the color balance correction, the color balance correction and the stray light correction can be made simultaneously with the shading correction of

10 image data, and further, uneven density caused from fluctuation of quantity of light in the sub-scanning direction can be corrected. In other words, a delicate color difference of image data caused by a difference in illumination between the reading

15 position of the shading plate 32 and the surface of the document table 12 can be corrected and the uneven density in the sub-scanning direction caused from the horizontal distortion of accuracy of the rail 27 also can be corrected.

20   Therefore, when the image data processed with the color balance correction and the stray light correction simultaneously with the shading correction and further, the uneven density correction in the sub-scanning direction is input into the digital color

25 printer 1, it becomes possible to easily reproduce a good color reproducible and high definition full color

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image in the digital color printer 1. Furthermore, all of the shading correction, the color balance correction, the stray correction and the uneven density correction can be made within the color

5 scanner 10. Therefore, when the image data output from the color scanner 10 after completing all the shading correction, the color balance correction, the stray light correction and the uneven density correction is used, it becomes possible to suppress

10 the fluctuation of a reproduced image caused from the fluctuation of characteristics at an image forming apparatus side such as an image forming terminal, etc. of a printer/a personal computer and form a full color image in uniform quality.

15   Further, the present invention is not restricted to the above-mentioned embodiments but can be deformed variously within the scope of the present invention. For instance, by forming a black reference plate near the white reference shading correction plate, the

20 shading correction plate before reading a document and the black reference plate are read and the read data may be used as the data for the shading correction. Further, it is optional to input the data read by the image reading device and processed for correction to a

25 color printer that is a computer terminal through the communication line without inputting directly to an

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image forming apparatus or once store in a page memory, etc. and read out as necessary.

Further, the number of pixels that are read at the measuring points in the second embodiment is not

5   restricted if an accurate measurement is possible.

As described above in detail, according to the present invention, when a white document placed on the document table is read by a photoelectric conversion means and using white document data comprising R, G, B

10   color signals that are obtained from this white document as desired values for the shading correction, the shading of image data is corrected, the color balance correction and the stray light correction can be made simultaneously with the shading correction.

15   Accordingly, when reading a document, a satisfactory color reproducible image data is obtained without causing a delicate color difference and using this image data, it becomes possible to easily reproduce a good reproducible full color image of high definition.

20   Further, all of these shading correction, the color balance correction and the stray light correction can be executed within the image reading device. Accordingly, when the image data output from an image reading device after the above-mentioned

25   correction/corrections is used, it becomes possible to suppress fluctuation of reproduced image caused by a

difference in characteristic at the image forming apparatus side and a full color image in uniform quality can be reproduced irrespective of difference in characteristic of an image forming apparatus.

5   Further, according to the present invention, when plural positions in the sub-scanning direction of a uniform density image document that is placed on the document table are read by the photoelectric conversion means and the shading of the image data is
10   compensated using sub-scanning data comprising plural R, G, B color signals obtained from the uniform density image document as desired values for the color balance correction, it is possible to correct the uneven density in the sub-scanning direction
15   simultaneously with the execution of the shading correction, the color balance correction and the stray light correction. Accordingly, when reading a document, a good color reproducible image data is obtained without causing uneven density in the sub-
20   scanning direction and using such image data, a good color reproducible high definition full color image can be easily reproduced in an image forming apparatus.

Furthermore, all of the shading correction, the color balance correction, the stray light correction
25   and the uneven density correction can be executed within the apparatus. Accordingly, when the image

data that is output from the image reading device
after completing the shading correction, the color
balance correction, the stray light correction and the
uneven density correction is used, it becomes possible

5   to suppress fluctuation of a reproduced image due to a
difference in characteristics of an image forming
apparatus side and to reproduce a full color image in
more uniform quality irrespective of a difference in
characters of an image forming apparatus.